[57] ABSTRACT

The invention is suitable for the manufacture of flat or shaped titanium matrix composite articles having improved mechanical properties such as lightweight plates and sheets for aircraft and automotive applications, heat-sinking lightweight electronic substrates, bulletproof structures for vests, partition walls and doors, as well as for sporting goods such as helmets, golf clubs, sole plates, crown plates, etc. A fully-dense discontinuously-reinforced titanium matrix composite (TMMC) material comprises (a) a matrix of titanium or titanium alloy as a major component, (b) ceramic and/or intermetallic hard particles dispersed in the matrix in the amount of ≤50 vol.%, and (c) complex carbide- and/or silicide particles at least partially soluble in the matrix at the sintering or forging temperatures such as $Ti_4Cr_3C_6$, Ti_3SiC_2, Cr_3C_2, Ti_3AlC_2, Ti_2AlC, Al_4C_3, Al_4SiC_4, $Al_4Si_2C_5$, Al_8SiC_7, V_2C, (Ti,V)C, VCr_2C_2, and $V_2Cr_4C_3$ dispersed in the matrix in the amount of ≤20 vol.%. The method for manufacturing TMCC is comprised of the following steps: (a) preparing a basic powdered blend containing matrix alloy or titanium powders, dispersing ceramic and/or intermetallic powders, and powders of said complex carbide- and/or silicide particles, (b) preparing the Al-V master alloy containing ≤5 wt.% of iron, (c) preparing the Al-V-Fe master alloy fine powder having a particle size of ≤20 μm, (d) mixing the basic powdered blend with the master alloy powder to obtain a chemical composition of TMCC, (e) compacting the powder mixture at room temperature, (f) sintering at the temperature which provides at least partial dissolution of dispersed powders, (g) forging at 1500-2300°F, and (h) cooling. The resulting TMCC has density over 98% and closed discontinuous porosity after sintering that allows making hot deformation in air without encapsulating. The invention can be used to produce near-full density near-net shape parts from titanium matrix composite materials with acceptable mechanical properties without a hot deformation.

14 claims